

Ground Water Quality Technical Report No. 13

An Evaluation of Methyl Tert-Butyl Ether (MTBE) in Groundwater at Leaking Underground Storage Tank Sites in Idaho



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INTRODUCTION

The implementation of the Idaho Risk Based Corrective Action (RBCA) Guidance document for Petroleum Releases in January 1997 resulted in the requirement for sampling for twenty chemicals of concern (COC). These chemicals include naphthalene, MTBE, ethylene dibromide, 1,2 dichloroethane, and twelve polycyclic aromatic hydrocarbons as well as the traditional chemicals benzene, toluene, ethylbenzene, and xylene.

The primary objective of the Groundwater Evaluation for Methyl Tert-Butyl Ether (MTBE) study was to evaluate the current magnitude of the MTBE threat to groundwater resources and risk to potential receptors from releases at leaking underground storage tank (LUST) sites in Idaho. It is intended to represent a snapshot in time and is not indicative of long-term trends. While the primary focus of the study was the chemical MTBE, other Idaho RBCA COC that historically have not been analyzed were also evaluated.

METHODS

From October through December 1997 the Idaho Division of Environmental Quality (IDEQ) collected groundwater samples from LUST sites across the state where petroleum contamination of groundwater had been detected. Samples collected by IDEQ staff were analyzed at the Idaho State Laboratory. In addition to the samples collected by IDEQ staff, ground water monitoring data received from sampling of additional LUST sites by responsible parties were added to the data set.

The sample collection was distributed among three types or groups: Group 1 samples represent sites with gasoline releases of "recent" origin (within the last 5 years), Group 2 samples are from diesel release sites, and Group 3 samples are from gasoline releases of historical origin (> 5 years old). Samples from all groups were analyzed for the following Idaho RBCA constituents: benzene, toluene, ethylbenzene, xylene, MTBE, and naphthalene. In addition Group 2 samples were analyzed for polycyclic aromatic hydrocarbons (PAH) and Group 3 samples were analyzed for the lead scavenger additives ethylene dibromide (EDB) and 1,2 dichloroethane (EDC).

EPA analytical methods used for IDEQ samples were 8021 for volatile organic compounds (VOC), including EDB and EDC, and 8270 for PAH. Other methods used for VOC by other laboratories included 8020 and 8260.

A total of 100 groundwater samples were obtained from 100 sites with known groundwater contamination. Where sample results were available for several wells at a given site the well with the highest concentrations was generally selected.

This sample population represents approximately one third of all the Idaho LUST sites with known groundwater impacts. The distribution of sites across the state in each IDEQ regional office is presented in Figure 1. A map showing the area represented by each IDEQ regional office is presented in Figure 2.

Figure 1. Percentage of Sample Sites and Groundwater Impacted LUST Sites by IDEQ Regions.

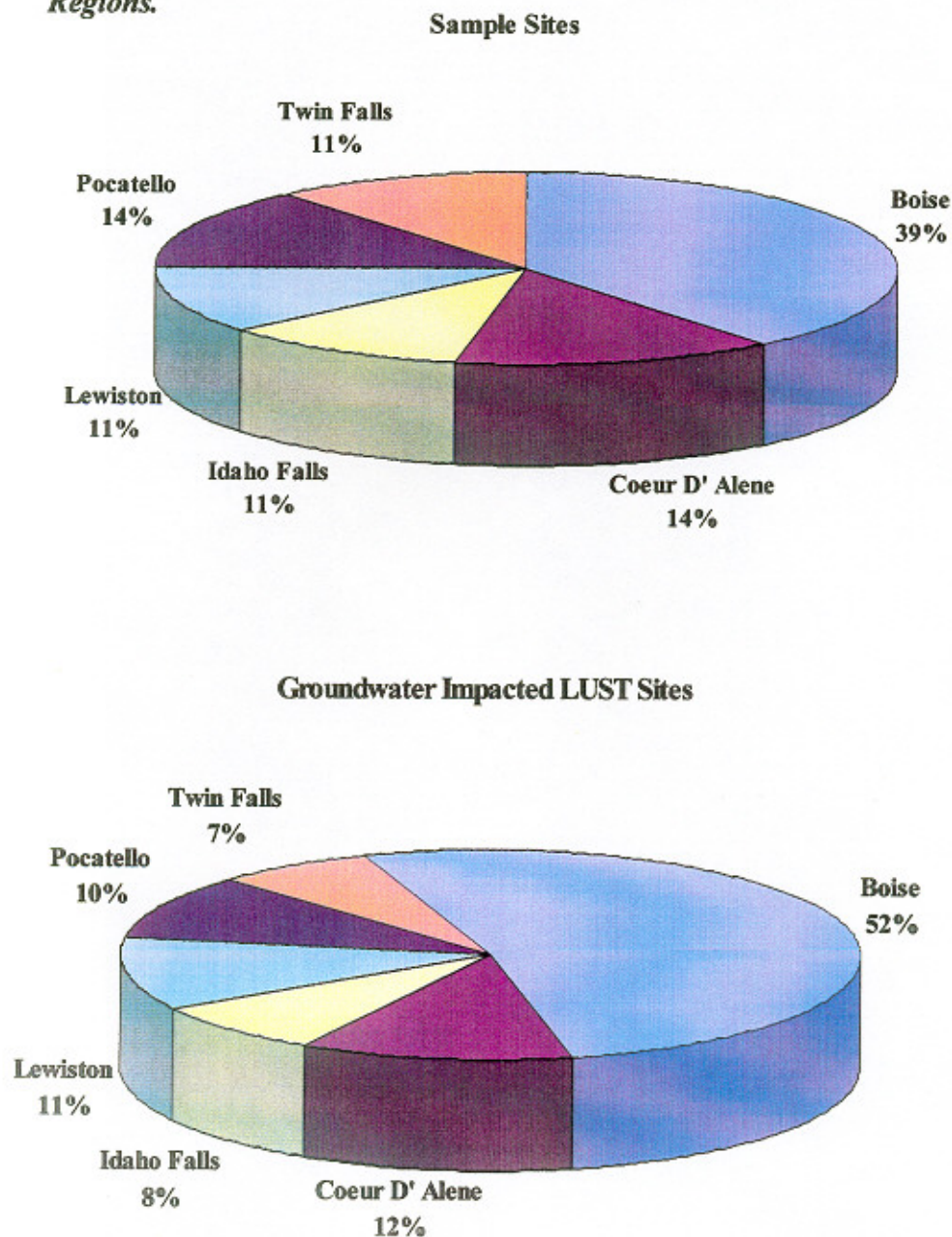
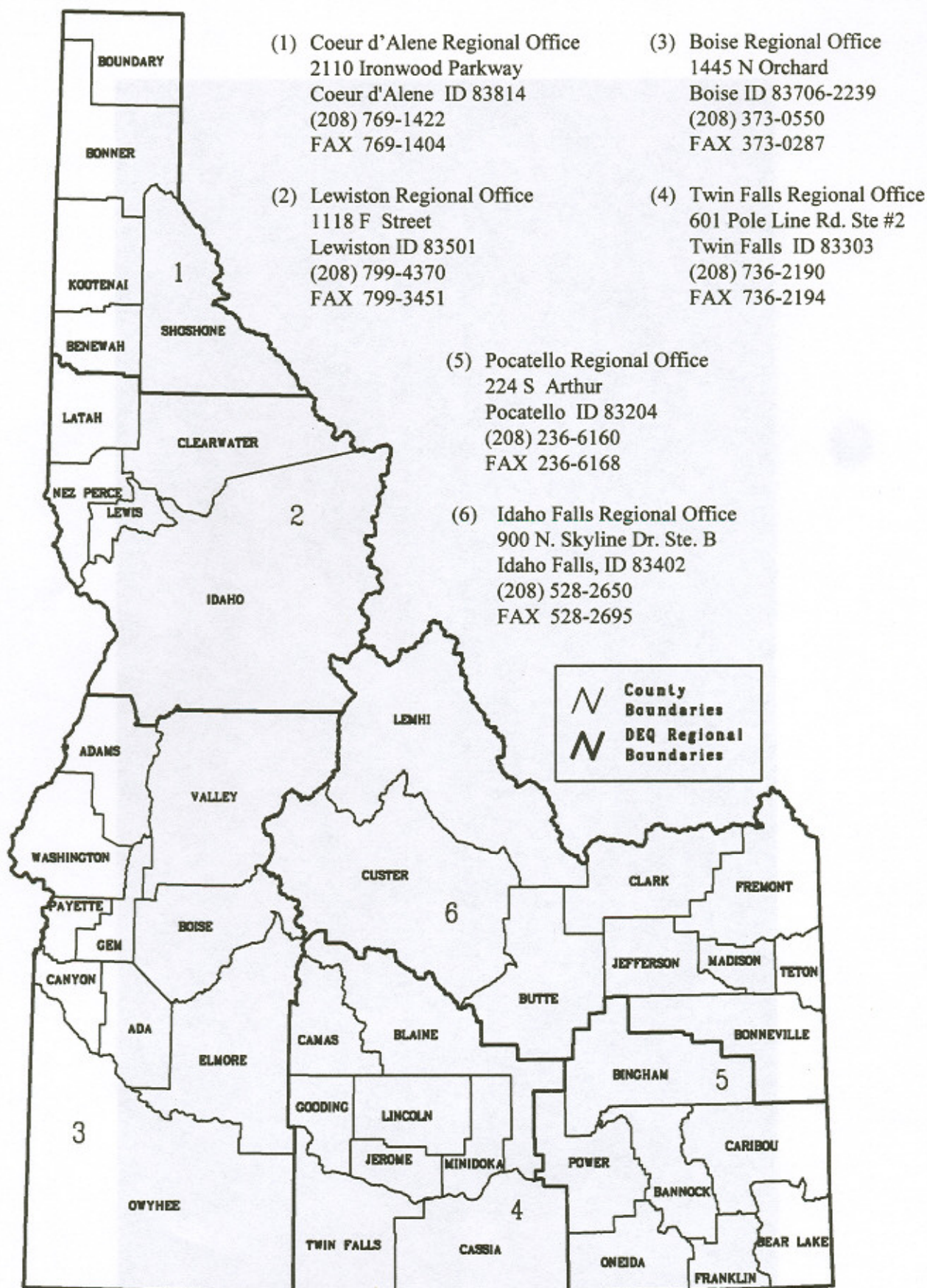


Figure 2. Idaho Division of Environmental Quality Regional Offices



When compared to the percentage of all LUST sites with groundwater contamination found in each region the sampling distribution appears representative. The distribution of samples among the product release groups and within IDEQ regions is shown in Table 1.

Table 1. Sample Site Distribution for Petroleum Product Release Groupings Among IDEQ Regional Offices.

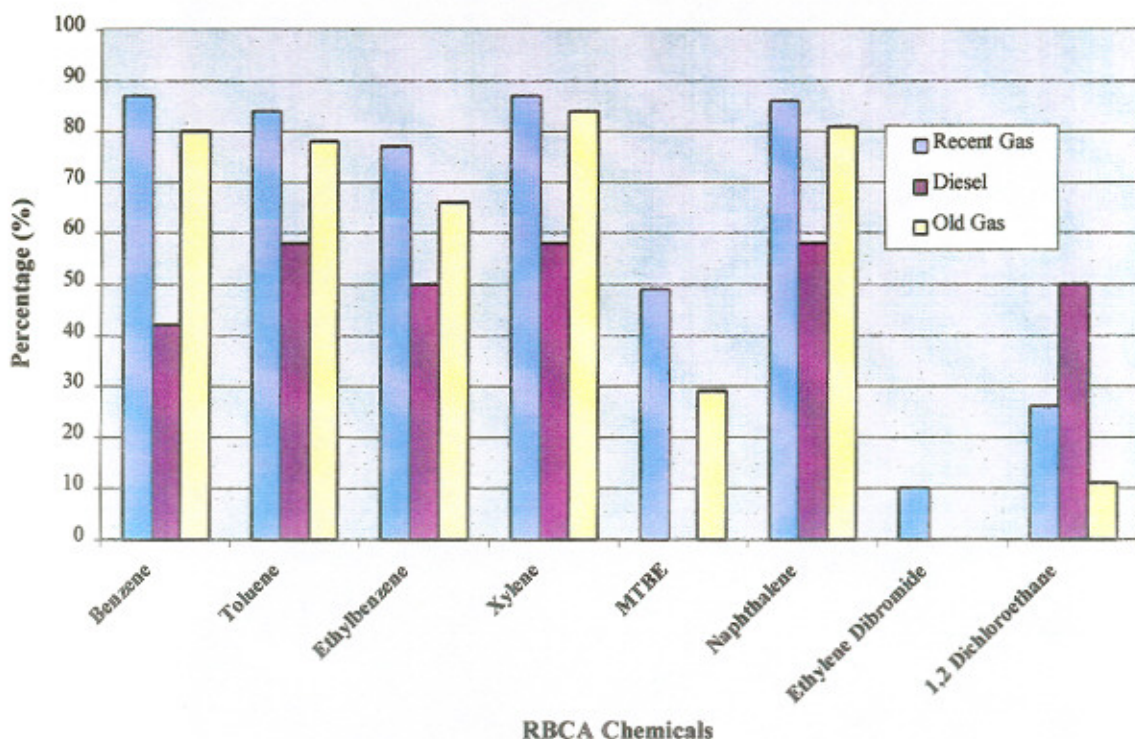
Group Type	All Sites	Boise	Coeur d' Alene	Idaho Falls	Lewiston	Pocatello	Twin Falls
1- Recent Gasoline	56	31	8	7	3	3	4
2- Diesel	12	5	2	1	0	4	0
3- Old Gasoline	32	3	4	3	8	7	7

RESULTS

Detections

Although hydrocarbon chemicals were detected in the past at all sites sampled, during this sampling event some sites had no detections for all constituents analyzed. The percentages of sites with detections for various chemicals for the three groups of sites is presented in Figure 3.

Figure 3. Percentage of Sample Sites with Detections for RBCA VOC Chemicals.



Detections varied by chemical. Benzene, toluene, ethylbenzene, xylene, and naphthalene (BTEX+N), as expected, were detected with much greater frequency at Groups 1 and 3 (gasoline) sites than at diesel release sites. MTBE was detected at about fifty percent of recent gas release sites and thirty percent of older sites. This finding supports a conclusion that in recent years MTBE use in Idaho has increased and is widespread, even though Idaho is not required to use reformulated gasoline to address air quality concerns.

Compared to other states surveyed by EPA, the overall percentage of MTBE detections (forty percent) places Idaho in the lower third to lower half nationwide (USEPA, 1998). MTBE was detected at group 1 sites in all IDEQ regions and all regions except Boise and Lewiston at Group 3 sites. The lack of detections at Group 3 sites in the Boise region is probably the result of the low sample size (3 sites).

The lead scavenger additives EDB and EDC were commonly added to regular, leaded gasoline. The use of these petroleum products have declined since the early 1980s with the phaseout of leaded gasoline. The additives showed anomalous patterns of detections in this evaluation with EDB only being found at recent gasoline sites and EDC being found at all types of sites. EDC was found least frequently at older gasoline release sites, contrary to expectations.

At twenty-two sites samples were analyzed for PAH. Eight sites, nine sites, and five sites were sampled in Groups 1, 2, and 3, respectively. Across all sites detections of at least one of the twelve RBCA PAH chemicals occurred at 7 sites (32%). The percentage of sites with detections in individual Groups was 13%, 55%, and 20% in Groups 1, 2, and 3. For the diesel release sites, Group 2, the PAH chemicals which were detected most frequently were fluorene (44%), fluoranthene (44%), pyrene (44%), and phenanthrene (33%).

Concentrations

The chemical concentration data for all sites is presented in Appendix Table A-1. The mean groundwater concentrations of the RBCA COC found in each group of sites is presented in Tables 2 and 3. These mean concentrations were calculated using only those sites which had detections for that chemical. Mean concentrations for most chemicals were lower for Group 3 sites compared to Group 1 sites. This very likely reflects the effect of remediation and/or natural attenuation.